ISD Software Acquisition Monitoring and Control Process

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Approved By: (signature)
Name: Joe Hennessy
Title: Chief, ISD

Responsible Office: 580/Information Systems Division (ISD)
Title: Software Acquisition Monitoring and Control

Asset Type: Process
PAL Number: 4.2

Purpose

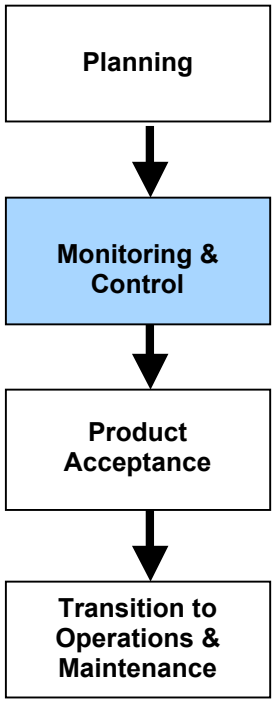
This process is performed to monitor and control the software acquisition project's progress so that appropriate corrective actions can be taken when the project's performance deviates significantly from the supplier's Software Management Plan (SMP).

Scope

This process is to be followed on all ISD mission software acquisition projects. Such projects may or may not be part of a larger, mission level project/program.

Context Diagram

Software Acquisition Management Processes



Roles and Responsibilities

Acquisition Manager (AqM)

- Primary responsibility for monitoring activities of the supplier's Software Management Plan, monitoring performance of the supplier, and contract compliance
- Reviews and approves supplier reports and deliverable
- Tracks and facilitates all contract changes
- Reports to management on supplier project status

Acquisition Technical Lead (AqTL)

- Responsibility for monitoring a specific part of the activities of the supplier's Software Management Plan, performance of the supplier, and contract compliance in support of the AqM.
- Other contract related duties as assigned by AqM.

GUIDANCE: This role is only needed for large contracts in which AqM needs assistance. On such projects, an AqTL could be assigned to each of the following: flight, ground, research, maintenance, etc.

Software Quality Engineer (SQE)

- Responsibility for providing independent and objective evaluations of supplier software processes and products throughout the life cycle (e.g., assessments of requirements management, configuration management, peer reviews, risk management, verification and validation.)
- Provides the AqM insight into the quality and maturity of the supplier's software processes and products.

Stakeholders

- Include managers, project team, customers, end users, suppliers, and others affected within the organization.

Contract Officer's Technical Representative (COTR)

- Responsible for issues dealing with contract (legal) issues.
- Responsible for reports on a periodic basis on supplier evaluations.

Main point of contact between project and upper management at GSFC.

GUIDANCE: The AqM and AqTL(s) shall use this list of typical questions that need to be kept in mind as one goes through the Monitoring and Control process. The following types of questions are the ones that need to be considered for any conversation or document or meeting. Consider these questions for any interchange between customer and supplier.

- *Did information provided affect the contract schedule?*
- *Did information provided affect the contract costs?*
- *Did information provided affect the contract services/products?*
- *Did information provided affect the contract resources (e.g., key people, facilities)?*
- *Did information provided affect the contract deliverables?*
- *Is a contract modification required?*

An answer of "Yes" to any of the above questions indicates a need to define what is missing, wrong or needs changing, establish the impact and notify the procurement office and/or the contract negotiator.

Usage Scenarios

Primary Usage Scenario:

This process starts as soon as the contract is awarded. The process is ongoing during the software development and through final delivery of all contract deliverables.

Inputs

Primary Usage Scenario:

- Software Acquisition Plan
- Contract Agreement
- Supplier planning documents: (current version)
  - Software Management Plan (SMP)
  - Risk Management
  - Software Development
  - Software Reuse
  - Software Configuration Management
  - Software Quality Assurance
  - Software Acceptance Test Plan (preliminary)
  - Sub-supplier Management
- Supplier status reports: (periodic)
  - Work accomplished during reporting period
  - Work planned for next reporting period
  - Planned/actual access to controlled documents and information
  - Problems, issues, and risks
  - Recommended solutions
  - Resolutions to previously identified problems, issues, and risks
  - Trips, significant meetings, and significant telephone calls
  - Subcontracting results achieved (planned versus actual)
  - Schedule and program/project milestone status (planned versus actual)
  - Labor hours expended (and by labor category if required) (planned versus actual)
  - Budget status (planned versus actual)
  - Deliverable status (planned versus actual)
  - Trends in software quality metrics data, number of problem reports, volatility of requirements, etc. as defined in contract
  - Material/Equipment purchased (planned versus actual)
  - Training and conferences attended (planned versus actual)
  - Draft and interim deliverables
  - Review materials
- Supplier financial reports
  - Invoices
  - Support documentation

Entry Criteria

Primary Usage Scenario:

- Contract has been awarded to supplier

Exit Criteria

Primary Usage Scenario:

- All contract products are delivered and accepted
- Contract is considered complete and ready for operational use

OR

- Contract has been stopped when an Abort/Suspend order is issued.

Outputs

Primary Usage Scenario:

- Accepted software, documentation, and other deliverables
- Reports on supplier project status
- Evaluation of supplier performance and approval for invoice payment
- Contract change requests, technical evaluations of changes, cost and schedule impacts

OR

- Reports to management, actuals, lessons learned, etc.

GUIDANCE: Contract change requests are 90% initiated from NASA while the rest are generally unsolicited proposals from the supplier.

Major Tasks

The **Acquisition Manager** shall with support from **AqTL** and **SQE**:

1.	Perform a Post Award Review	**AqM, AqTL, SQE**
2.	Monitor execution of the supplier's software development effort	**AqM, AqTL, SQE**
3.	Monitor performance of supplier	**AqM, AqTL, SQE**
4.	Monitor contract	**AqM, AqTL, SQE**
5.	Monitor commitments	**AqM**
6.	Attend formal reviews and meetings	**AqM, AqTL, SQE**
7.	Manage corrective actions	**AqM**
8.	Review progress and generate reports	**AqM, SQE**
9.	Document lessons learned	**AqM, AqTL, SQE**

Task 1

Perform a Post Award Review **AqM, AqTL, SQE**

a) Review software requirements, schedules, deliverables, funding, and supplied government furnished property (GFP) for needed changes.

b) Review the time allowed for review/approval of various reports and deliverables to verify sufficient time has been allotted for proper review by all affected Acquisition technical leads (AqTL).

c) Document all required changes to the contract and submit the contract change requests.

GUIDANCE: There is generally a period just after contract award but before work starts on the project when changes can be negotiated and won't require a formal change request.

Task 2 **Monitor execution of supplier's software development effort**

By SQE

a) Monitor the supplier's Software Configuration Management (SCM) processes and products
   - *GUIDANCE: Review supplier's SCM plans, procedures, resources, and standards for providing baseline management and control of software requirements, design, source code, data, and documentation.*
   - *Periodically assess/audit supplier on how well they are using their documented SCM processes for control of products.*

b) Monitor the supplier's Software Quality Assurance (SQA) program
   - *GUIDANCE: Review supplier's SQA plans and procedures, resources, and provide surveillance to assure that the supplier is performing to their plans and procedures*
   - *Review software quality assurance records and reports for insight into their activities and progress*

c) Monitor the supplier's Software Risk Management (SRM) processes
   - *GUIDANCE: Review supplier's plans, resources, procedures, and standards for SRM activities to ensure adequacy.*
   - *Periodically assess/audit supplier's SRM activities to determine how well they are being followed.*
     - ❖ *Are risks being actively monitored?*
     - ❖ *Are there plans for risk mitigation? Being performed?*
     - ❖ *Are there any risks that are of heightened concern?*
     - ❖ *What are the trends in risks over time?*
   - *Apply the ISD Risk Management process to the supplier*

d) Monitor the supplier's Software Management Plan (SMP)
   - *GUIDANCE: Review supplier's software development processes, procedures, tools, resources, schedules, and deliverables*
   - *Periodically assess/audit the supplier's SMP processes and procedures to determine how well they are being followed.*

By AqM and AqTL

e) Monitor the supplier's software engineering and project management process activity.

f) Monitor activities required to conduct independent assessments by the NASA IV&V facility or by the GSFC SQA organization. (*if applicable*)

g) Monitor the progress of the contract office in progressing with all contract change requests and modifications. Track and facilitate their completion.

h) Document any problems encountered.

a) Review periodic supplier status reports, especially planned versus actual data. Look for trends in the data.

GUIDANCE: reference ISD Measurement and Analysis Process at http://software.gsfc.nasa.gov/process.cfm

b) Monitor Cost and Schedule milestones
   - *Is the schedule realistic?*
   - *Is the schedule being met?*
   - *Is planned functionality included in completed builds?*
   - *Is the build plan being met?*
   - *Is the cost realistic and in line with schedule progress?*

c) Monitor the supplier's staffing plan
   - *Is the staff stable?*
   - *Is the supplier meeting his staffing plan?*
   - *Is the staff well qualified for the work they are doing?*

   GUIDANCE: If turn-over occurs in supplier lead personnel, review contractual requirements (SOW, deliverables, etc.) with replacement personnel.

d) Monitor the supplier's resources including computer, network, and the software engineering environment
   - *Are they adequate to do the work?*
   - *Will they be ready on schedule?*

e) Monitor the software design
   - *Are the requirements stable?*
   - *Is the design functionally visible?*
   - *Does the supplier have a good understanding of what is required?*
   - *Is the evolving capability and performance of the supplier's product likely to impact development on the GSFC side of the interface?*

f) Monitor the integration and testing of the product
   - *Are these activities on schedule?*
   - *What is the quality of the products being produced?*
   - *What is the requirement's volatility, defect density, or software problem reporting trends?*
   - *Review of the preliminary Acceptance Test plans for coverage of all software requirements.*

g) Document any problems encountered

Task 4 **Monitor contract** **AqM, AqTL, SQE**

a) Monitor delivery and quality of contract deliverables
   - *Are contract deliverables showing up on time as scheduled?*
   - *Are contract deliverables of acceptable quality?*

b) Monitor actual costs for labor categories and associated effort, facilities cost, resource costs, etc. against what was in the supplier's plans.

c) Monitor contingency funds being held and spent by supplier at software level or at higher programmatic levels.

d) Monitor any incremental funding that is going to the supplier to make sure it arrives as specified by contract.

e) Monitor non-technical deliverables and reports required by the contract.

f) Document any problems encountered.

GUIDANCE: Not-technical deliveries may include such items as Safety and Health Plans, Security Plans and associated reports of security breaches, Equal Employment Opportunity reports, Surveillance Plan, etc.

Task 5 **Monitor commitments** **AqM, Stakeholders**

a) Monitor all commitments against the plan.

b) Monitor the status of stakeholder involvement against the plan.

c) Identify critical dependencies between project and suppliers.

d) Identify those commitments that have not been satisfied or those that are at significant risk of not being satisfied.

e) Document the results of these reviews.

GUIDANCE: As a minimum do the following:

- *Coordinate the schedules for deliverables from suppliers and government groups to the project.*
- *Coordinate delivery of deliverables from suppliers or government groups. Are contract deliverables showing up on time as scheduled? Are contract deliverables of acceptable quality?*
- *Monitor the readiness of the organization that will take delivery of the software deliverable and the progress it makes to get ready.*

Task 6	Attend formal reviews and meetings	AqM, AqTL, SQE, and Stakeholders

a) Attend major formal reviews for the project
- System Requirements Review (SRR)
- System Concept Review (SCR)
- Preliminary Design Review (PDR)
- Critical Design Review (CDR)
- Acceptance Test Readiness Review (ATRR)
- Operational Readiness Review (ORR)

GUIDANCE: Milestone reviews are planned during project planning and are typically formal reviews. See checklists at http://software.gsfc.nasa.gov/process.htm *for details for SRR, SCR, PDR, CDR, ATRR, and ORR. These checklists can be used as a check for content in the supplier's formal reviews.*

b) Attend important and significant meetings
- Contract Management Meeting
  - *Project management plans, progress, and changes*
  - *Subcontract management plans, progress, and changes*
  - *Work breakdown structures and changes*
  - *Risk identification and mitigation*
  - *Planned versus actual cost*
  - *Lessons learned*
- Software Developers Meeting
  - *2 types: Progress Reviews and Technical Reviews*
  - *Verify supplier is following software development plans*
  - *Schedules, progress and changes*
  - *Risk identification and mitigation*
- Interface Working Group Meeting
  - *Technical interfaces*
  - *GSFC/supplier interfaces at working level*
- Configuration Management Meeting
  - *Review supplier's configuration management plan, progress, and changes.*
- Software Quality Assurance Meeting
  - *SQA plan, progress, and changes*
  - *Are the quality objectives for this contract being met?*
  - *Is the supplier SQA adequate and acceptable?*
  - *Identify the interfaces between the supplier's SQA and the GSFC SQA Code 300 organization.*
- System Integration, Test, and Verification Meeting
  - *Review supplier's system integration test and verification plan,*

progress, and changes

- ❖ *Review supplier's Software Acceptance Test Plan (preliminary)*

- System Security and Safety Meeting
  - ❖ *Review the supplier's system safety plan, progress, and changes.*
- Independent Verification and Validation Meeting (if applicable)
  - ❖ *Review the IV&V plan, progress, and any proposed changes*
  - ❖ *Review IV&V issues, risks, and recommendations.*

c) For both formal reviews and important meetings, collect and document significant issues and their impacts as Review Item Dispositions (RIDs) and Requests For Action (RFAs).

d) Track action items and issues to closure

GUIDANCE: Corrective action is required when the issue may prevent the project from meeting its objectives if left unresolved. Examples of potential actions include the following:

- *Modifying the statement of work*
- *Modifying the requirements*
- *Revising estimate plans and schedules*
- *Renegotiating commitments*
- *Adding resources*
- *Changing appropriate processes*
- *Revising project risks*

Task 7	**Manage corrective actions**	**AqM, SQE, Stakeholders**

a) Gather issues for analysis developed during previous tasks or input from other processes.

b) Analyze issues to determine need for corrective action. Document the analysis and appropriate actions needed to address the identified issues.

c) Review and get agreement with the relevant stakeholders on the actions to be taken and the priority to be assigned for their completion.

d) Negotiate changes to internal and external commitments.

e) Monitor the corrective actions for completion

f) Analyze results of corrective actions to determine their effectiveness. If previous corrective actions did not produce the desired result, then return to step b) above to rework the issues involved.

GUIDANCE: Issues are collected from reviews and the execution of other processes. Examples of issues to be gathered include:

- *Issues discovered through performing product development, maintenance, reviews, execution of other processes, verification and validation activities*
- *Significant deviations in schedule, cost, staffing, quality, product size, requirements, risk, etc. from the estimates in the supplier's Software Management Plan (SMP)*

- *Commitments (internal and external) that have not been satisfied*
- *Significant changes in risk status*
- *Data access, collection, privacy, safety, and security issues*
- *Stakeholder representation or involvement issues*
- *Change Requests, Impact Analysis (for Requirements changes)*
- *Requests For Action (RFAs)*
- *Review Item Dispositions (RIDs)*

Task 8	Review progress and generate reports	AqM, SQE, Stakeholders

a) Assemble project measures and the identified significant deviations and trends from what was planned in the supplier's SMP

b) Use the data to generate Metrics Reports.

GUIDANCE: reference ISD Measurement and Analysis Process at http://software.gsfc.nasa.gov/process.cfm

c) Produce project status report (includes Metric data and earned-value).

GUIDANCE: reference ISD Branch Status Review Template at http://software.gsfc.nasa.gov/process.cfm

d) Communicate status on assigned activities and work products to relevant stakeholders, including project, line management, and the project team.

e) Review the results of collecting and analyzing measures for controlling the project with relevant stakeholders.

f) Identify and document significant issues and action items resulting from these project progress reviews.

g) Track action items and issue resolution to closure.

h) Review supplier financial reports and approve payments of supplier invoices as required.

i) Write supplier evaluation reports as required (*usually every six months*).

j) Make decision on completion of software development and readiness to proceed to Product Acceptance.

GUIDANCE: Data that should be included in the report: progress tracking data, schedule, risk, cost, effort, software error rates including severity, testing results, deficiency report (DR) summary, issues, etc.

Examples of progress reviews include the following:

- *Reviews with the project team*
- *Reviews with project management and suppliers*
- *Reviews with line management*
- *Reviews with customers and end users*

Stakeholders include managers, project team, customers, end users, suppliers, and others affected within the organization. Include these stakeholders in reviews as appropriate.

Task 9	Document lessons learned	AqM, AqTL, SQE

a) Collect and document issues that are found to have had a significant positive or negative impact on the project. If possible provide a suggestion for improvement to processes.
b) Submit these significant issues (Lessons Learned) to the GSFC Engineering Process group, the GSFC lesson's learned website (see below), and distribute to relevant stakeholders.

GUIDANCE: Lessons Learned are those significant issues encountered during a project that have affected, either positively or negatively, the schedule, cost, effort, staffing, quality, product size, requirements, risk, required resources, commitments, training, stakeholder involvement, processes, etc. Reference **ISD Lessons Learned Process** *at* http://software.gsfc.nasa.gov/lessons.htm

To view previous Lessons Learned or to submit a new one go to the GSFC web site http://software.gsfc.nasa.gov/lessons.htm.

Measures

Recommended Measures:

- Schedule (planned versus actual)
- Cost (planned versus actual)
- Effort (planned versus actual)
- Progress (planned versus actual)
- Software quality (defects by severity)
- Requirements volatility (total, additions, changes, deletions)
- Size measure (determine what makes most sense)

Required Measures:

The required measures are dependent upon the terms and conditions of the contract. All measures specified there should be tracked.

Tools and Templates

Name	Description
Action Item Tracking Tool	Tracking and maintaining status
Earned Value Tool	Excel-based workbook tool available at http://software.gsfc.nasa.gov/process.cfm.
Microsoft Project Tool	Tool for tracking schedule available as COTS software from Microsoft Corp.
Risk Tracking Tool	Tracking and maintaining status

Training

Course Name	Description
Earned Value	Earned Value strategies and methods for the first time user of the Excel-based workbook tool. For more details see: http://software.gsfc.nasa.gov/classlist.cfm
Foundations of Project Management (FPM)	FPM provides interesting and relevant instruction of the methodologies, techniques, terms and guidelines used to manage cost, schedules and technical aspects through the life cycle of a project. The course is invaluable for project control and support personnel who need a better grasp of the project world. For more details see: http://ohr.gsfc.nasa.gov/DevGuide/Home.htm
Quantitative Software Management (QSM)	A two-day course developed at JPL but includes GSFC-specific information. Course materials include lecture presentations, tools, spreadsheets, and supporting information. Individual presentations, tools, etc. can be accessed from the web page address provided. For more details see: http://software.gsfc.nasa.gov/classlist.cfm
Continuous Risk Management (CRM)	This 2-day course familiarizes the student with the fundamentals of Continuous Risk Management (CRM) and provides for interactive learning through the use of various methods and tools and a hypothetical space flight project case study. The second day is dedicated to organization-specific activities that will:1)establish and organization-specific risk baseline, 2)practice the functions of CRM paradigm, 3) promote teambuilding and a more cohesive work environment, 4) provide risk information that can be acted on immediately upon completion of the course. Emphasis can be placed on the creation of Risk Management Plan as deemed necessary by each organization. For more details see: http://ohr.gsfc.nasa.gov/DevGuide/Home.htm
Software Project Management	The Software Project Management Course is a 5-day, residential, intermediate project management course targeted at those interested in increasing their knowledge of systems and software. Attendees should have some experience in managing projects. The course provides an overview of project management and associated topics. Classroom activities are augmented by hands-on workshops and group projects (e.g., project management plans, earned value, risk management, cost/schedule/ technical performance monitoring). For more details see: http://software.gsfc.nasa.gov/classlist.cfm

Training continued on next page

Training (Continued)

Course Name	Description
Technical Manager's Training (TMT)	The TMT is a 6-day residential program that focuses on presenting a high level overview of how work gets done in the Goddard environment. The Course Objectives are to: a) Learn about the Life Cycle of a project within the Goddard environment b) Get familiar with principles of good Project Management, (How to plan, organize, implement, and control technical projects) and c) Learn principles of how to increase effectiveness within work teams through collaborative team participation. There is a two-hour orientation at Goddard Greenbelt, 6 full days at Wallops and an hour and a half wrap-up session the following week in Goddard Greenbelt. The course begins on a Sunday and ends on a Friday. Developmental activities begin on the bus ride to Wallops.
COTR Training	Legal issues for acquisition. Required for AqM and AqTL roles.

Training availability can be checked at http://software.gsfc.nasa.gov/training.htm.

References

This process is consistent with the following policies, standards & references.

- **Glossary:** http://software.gsfc.nasa.gov/glossary.cfm
  Defines common terms used in ISD processes
- **ETVX Diagram:** A hyper-link to this diagram can be found in the Process Asset Library on-line version of this document.
- **Process Asset Library:** http://software.gsfc.nasa.gov/process.cfm
  Library of all ISD process descriptions
- **NASA Software Engineering Requirements,**
  NPR 7150.x, at http://gdms.gsfc.nasa.gov/gdms
- **ISD Branch Status Review Template**
  at http://software.gsfc.nasa.gov/process.cfm
- **ISD Measurement and Analysis Process**
  at http://software.gsfc.nasa.gov/process.cfm
- **ISD Lessons Learned Process:**
  http://software.gsfc.nasa.gov/process.cfm
- **ISD Software Risk Identification**
  at http://software.gsfc.nasa.gov/process.cfm
- **ISD Software Risk Monitoring and Control**
  at http://software.gsfc.nasa.gov/process.cfm**l**
- **ISD SRR Checklist** at http://software.gsfc.nasa.gov/process.cfm
- **ISD PDR Checklist** at http://software.gsfc.nasa.gov/process.cfm
- **ISD CDR Checklist** at http://software.gsfc.nasa.gov/process.cfm
- **ISD ATRR Checklist** at http://software.gsfc.nasa.gov/process.cfm
- **ISD ORR Checklist** at http://software.gsfc.nasa.gov/process.cfm

Quality Management System Records	Controlled Document / Description	Record Custodian
	Software Acquisition Management Plan (SAMP) – signed and dated by the Branch Head, Software Technical Manager, and Customer. ISD CCB approval is only required if the plan is not subject to Project CM.	Acquisition Manager

Change History

Version	Date	Description of Improvements
1.0	July 15, 2005	Initial approved version by CCB

Software Acquisition Monitoring & Control ETVX* Diagram

Number: 580-ED-034-01
Effective Date: July 15, 2005
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Approved By: (signature)
Name: Joe Hennessy
Title: Chief, ISD

Responsible Office: 580/Information Systems Division (ISD)
Title: Software Acquisition Monitoring and Control

Asset Type: ETVX Diagram
PAL Number: 4.2

Inputs	Entry Criteria	Major Tasks	Exit Criteria	Outputs
Contract Agreement **AND** Software Acquisition Plan **AND/OR** Supplier planning documents **AND/OR** Supplier status and financial data	Contract has been awarded	**1.** Perform Post Award Review **2.** Monitor execution of supplier's software development effort **3.** Monitor performance of supplier **4.** Monitor contract **5.** Monitor commitments **6.** Attend formal reviews and meetings **7.** Manage corrective actions **8.** Review progress and generate reports **9.** Document lessons learned **Verification and Validation** **1.** Software CM audits **2.** GSFC SQA evaluations of processes and products **3.** Software IV&V assessment	All contract product are delivered and accepted **AND** Contract is considered complete and ready for operational use **OR** Contract has been stopped when an Abort/Suspend order is issued	Software, documentation and other deliverables Reports on supplier project status Evaluation of supplier performance and approval for invoice payment Contract change requests, technical evaluations of changes, cost and schedule impacts **OR** Reports to management, actuals, lessons learned, etc.

* NOTE: ETVX stands for **E**ntry-**T**ask-**V**alidation / **V**erification-e**X**it

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